

## **Remarks**

### **Status of the claims**

Claims 1-20 are pending in the application. Claims 1 and 2 are hereby cancelled. Dependent claims 3-5 have been rewritten in independent form.

### **Claim objections**

Claim 6 was objected to because of a missing "and" after process step (b). The claim has been amended to include the missing word.

### **Summary of the invention as claimed**

Applicants claim a fatty acid ester mixture made from pentaerythritol, a pentaerythritol oligomer or mixtures thereof, and a fatty acid component of 6-22 carbon atoms, wherein the ester mixture contains less than 0.3% by weight of C17 fatty acid acyl groups and has a melting point of at least 30°C. The fatty acid mixture contains monoesters in about 5-30% by wt, preferably about 10-25%, diesters in about 20-50% by wt, preferably about 25-40%, and triesters in about 25-50% by wt, preferably about 30-45%. In an additional embodiment, the fatty acid mixture contains monoesters in about 12-19% by wt, diesters in about 25-35% by wt, triesters in about 30-40% by wt, and tetraesters in about 6-11% by wt. An additional embodiment claims a fatty acid ester mixture wherein the fatty acid component contains C16 acyl moieties in about 40-50% and C18 acyl moieties in about 45-55% by wt.

Another embodiment is a process for the production of a C16/C18 fatty acid pentaerythritol ester mixture comprising the steps of (a) providing about 1.8-2.2 mol of a fatty acid mixture comprising C16:C18 fatty acids in a ratio of about 40-50 : 45-55 wt %, per mol of pentaerythritol; (b) esterifying component (a) at temperatures ranging from about 180-250°C under an inert gas in the absence of solvent; and (c) stirring the reaction mixture under vacuum until an acid value of less than 1, and an OH value of 145-158 are achieved. Unreacted pentaerythritol may be removed by filtration. A

further step of treating the reaction mixture with hydrogen peroxide may be included.  
The fatty acid mixture of step (a) may be vegetable-derived.

A further embodiment is a cosmetic and/or pharmaceutical composition of the fatty acid ester mixture.

Rejections under 35 U.S.C. § 102(b)

Claim 1 was rejected under 35 U.S.C. § 102(b) as being anticipated by Breusch et al. (Chem. Ber., 1955, 1511-1519).

Claims 1, 2, 4 and 5 were rejected under 35 U.S.C. § 102(b) as being anticipated by Sakurai et al. (US 4,113,635, "Sakurai").

Claims 1 and 2 have been cancelled, thereby obviating the rejection over Breusch.

Although Sakurai discloses lubricant mixtures of pentaerythritol fatty acid ester mixtures, it is noted that no ranges are disclosed or claimed for the distribution of mono-, di-, tri-, and tetra-esters. Specific examples are provided in the examples giving single data points. It appears that any distribution of these species is acceptable as a lubricant. For example, Table 1 shows mixtures A, B, G and H having primarily diester (80 and 86%), mixtures E and F having primarily triester (70%), and mixtures C and D having more equal distribution among the mono-, di- and tri-ester species. Examples 3 and 4 disclose mixtures containing 10% tetraester in addition to 20-40% of the mono-, di- and tri-esters. Applicants' claims 4 and 5 do not overlap these examples in the claimed distribution ranges. With regard to Table 1, mixture C/D, with 31% monoester is outside the range of both instant claims 4 and 5. With regard to Example 3, the composition contains 10% tetraester, which is not a component of instant claim 4; Example 3 also contains 20% monoester which is outside the range of instant claim 5 (12-19%). With regard to Example 4, the mixture contains 40% monoester, which is

outside the ranges of both instant claims 4 and 5. Thus, in contrast to the statement of the Examiner, the ranges of instant claims 4 and 5 do not overlap the disclosure of Sakurai.

Rejections under 35 U.S.C. § 103(a)

Claims 1 and 3 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Sakurai in view of Knothe et al. (American Chemical Society, 1997, 172-207).

In contrast to the Examiner's statement, Sakurai does not disclose a carbon range of C6 to C18 for the fatty acids referenced in col. 3, lines 40-47. Representative acids are referenced. As noted by the Examiner, Sakurai fails to disclose pentaerythritol fatty acid ester mixtures having 40-50% C16 and 45-55% C18 acyl components. Sakurai does disclose a beef tallow fatty acid ester of pentaerythritol, Table 1, entries G/H.

Knothe indicates that beef tallow consists of 2-6% C14, 25-37% C16, with the remainder being C18 fatty acids. Subtracting the maximum % of C14 (6%), gives a minimum range of 57-69% C18 fatty acids ( $100 - 37 - 6\%$ , and  $100 - 25 - 6\%$ ). Thus the C16:C18 ranges of beef tallow given by Knothe (25-37 : 57-69) do not overlap those of Applicants' claims (40-50 : 45-55). In this regard Knothe does not cure the deficiency of Sakurai and actually teaches away from Applicant's invention in that the instant ranges are not achieved for beef tallow esters. Thus one of ordinary skill in the art would not arrive at Applicants' claimed fatty acid ester mixtures by reading Sakurai in view of Knothe.

Claims 6-10 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Miranol Chemical Company (EP 0163806, "Miranol") in view of Knothe.

Miranol discloses a process for preparing esters of pentaerythritol and fatty acids using 0.5-2.5 moles of fatty acid per mole of pentaerythritol at reaction temperatures

between 150 to 200°C. The difference in Miranol versus Applicants' invention is the requirement for a strong acid catalyst such as p-toluene sulfonic acid or sulfuric acid in Miranol. Miranol states that the reaction can be carried out in the absence of solvent in some cases, without indication where solventless reactions are applicable, but this requires even more catalyst (p. 4, lines 28-35). Then the reaction is continued under these acid-catalyzed conditions to effect condensation to the oligomers of the invention (p. 5, lines 3-6).

In contrast, Applicants' process of esterification proceeds without the need for strong acid catalysis. In this regard Miranol teaches away from Applicants' invention since one skilled in the art reading Miranol would understand that an acid catalyst is required for the indicated esterification reaction.

The Examiner is correct in stating that Miranol fails to disclose the OH value of 145-158, water removal by distillation, removal of unreacted pentaerythritol by filtration, and treating the reaction mixture with hydrogen peroxide. The Examiner states in the office action (p. 7, second paragraph) that the OH value relates to neutralization of the acid catalyst with methoxide. Actually the OH value is a measure of the number of free hydroxyl groups in the product, and is a critical piece of analytical data describing Applicants' product esters. Also, the addition of hydrogen peroxide is not a neutralization step, but rather a bleaching step to improve color. Addition of Knothe does not cure these deficiencies.

Claims 11-20 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Plough, Inc. (EP 0179416, "Plough") in view of Miranol.

Plough discloses a cosmetic composition containing pentaerythritol tetra C20-C24 esters. Specifically tetraesters are disclosed. The Examiner correctly states that Plough fails to disclose monoesters, diesters and triesters as components of a pentaerythritol ester mixture. The Examiner states that "it is well within the purview of

the skilled artisan to expect that the product produced by the [esterification] process would have a mixture of mono, di and tri esters" (Office Action, p. 9, second paragraph). However it is clear that Plough intended to claim tetraesters, which are more difficult to prepare than partial esters, requiring excess fatty acid and extended reaction times to convert pentaerythritol completely into the tetra ester. The active ingredient of Plough is the tetraester; the active ingredient of Applicants invention is a mixture of partial esters containing some free OH component (see the OH value limitation).

Also the Examiner has stated that "[i]n view of the references set out above, it would have been obvious to one of ordinary skill in the art of cosmetics to use pentaerythritol esters, a pentaerythritol oligomer or mixtures thereof to improve upon the sensory advantages of cosmetic products such as shown in Plough with a broader range of fatty acid esters of pentaerythritol as shown in Miranol..." (Office Action, p. 9, fourth paragraph). However, this is contraindicated by Plough, p. 3, first paragraph, "[s]urprisingly, the tetra ester of pentaerythritol and C18 fatty acids (stearic and oleic acids) do not provide the superior advantages of those included within the scope of the compositions of the present invention." Thus a group of fatty acids (C18) in the middle of the range claimed by Applicants (C6-22), is specifically excluded by Plough as providing tetraesters useful in cosmetic compositions. Thus Plough teaches away from Applicants' invention.

In view of the above claim amendments and remarks, the anticipation and obviousness rejections should be withdrawn, and the pending claims allowed.

Respectfully submitted,

October 13, 2008

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